DIRECTED WORD CHAIN NETWORKS (PART 3)

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This is the third of a series of articles on directed word chain networks; the first two can be found in the August 1991 Word Ways. Specifically focusing on (8,4) word chains, it is divided into two sections. The first introduces a two-dimensional construction called a mesh; the second updates and extends Part 2, using an enlarged word list. All terms are defined in Part 1.

As described in Part 2, the original list of 2813 words containing 960 different frags was taken from a computerized Official Scrabble Players Dictionary database, augmented by a hand search of Webster's Second and Third and Chambers Twentieth Century Dictionary for eight-letter words suitable for long chains. Since the earlier article, further searches of Webster's Second (plus an exchange of lists with Christopher McManus) has resulted in a list of 6191 words (a 120% increase) with 1394 different frags (a 45% increase). Note how few new core frags accompany the large increase in words; the original search fairly well established the core. The frag types are tabulated below ("other" frags consist of preceders and followers, both defined in Part 1):

<table>
<thead>
<tr>
<th>frags</th>
<th>core</th>
<th>beginner</th>
<th>ender</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 2</td>
<td>960</td>
<td>507</td>
<td>119</td>
<td>142</td>
</tr>
<tr>
<td>Part 3</td>
<td>1394</td>
<td>659</td>
<td>205</td>
<td>181</td>
</tr>
</tbody>
</table>

Meshes

A mesh is a rectangular array of frags from word chains arrayed in rows and columns and interlocking in the manner of a word square. Below are samples of the largest meshes I could find using a microcomputer. Read the frags pairwise from left to right and from up to down; all eight-letter combinations are solid words. These large meshes have a more or less common theme, so only a few are shown. I was not quite able to complete any 6x6 meshes; both 4x9 and 6x6 meshes use 36 frags, but more intersection is required in the latter. Quite a few 5x7 meshes are possible.

fore-body-surf-fish-hold-over-long-hair-bird lower left corner
play-work-boat-tail-back-fire-wood-worm-seed alternates: side-lock, side-line, pipe-line,
down-hand-bill-head-wind-ball-cock-weed-like town-wear-able-gate-ward-room-mate-less-ness
fore-hand-line-side-long-wool-ball lower left corner
hold-fast-back-bone-wood-rock-weed alternate: cook-book
over-land-wash-tail-wind-fish-hook shop-lift
fire-lock-work-head-ship-worm-like plug-hole-able-gate-ward-less-ness
Word chain

Word Ways, divided into construction 2, using an

word types containing 100,000 Scramble tiles of Web-

ary Dictionary the earlier an exchange list of 6191

ize in words; frag types recoders and

other

192
349

chains arrayed r of a word d find using to right and solid words. me, so only 6x6 meshes; intersection is table.

ft corner es: side-lock, ne, pipe-line, ak, land-line

corner

cook-book

shop-lift

over-fire-back-hand-play-room
long-tail-wind-blow-down-some
hair-band-fish-line-side-wise
slip-case-wood-work-head-like
horn-book-land-ship-ward-walk
bail-able-gate-ways outs
fire-plow-foot-walk-outs-cent
wood-fish-hold-over-well-ring
land-line-back-work-head-lock
rail-side-wash-hand-load-able
road-show-down-play-some-gate
book-case-seed-like-ways

tide-flat-foot-note-case-mate
mark-land-rail-head-work-ship
down-line-side-long-hand-load
turn-back-bone-tail-like-some
over-fire-wood-ward-walk-ways
wind-fall-fish-able ides
fore-play-folk-rock-rose-leaf
take-down-land-fall-fish-worm
over-hand-line-back-bone-wood
slip-rail-side-band-work-shop
knot-head-note-case-book-lift
horn-like-wise-weed-less

More than half a million 5x5 meshes can be constructed out of my 6191-word database; a tiny fraction of these are listed in the appendix. All of them shown have variations. Most meshes of any size begin with fore or over and end with like or less converging to ness; however, the appendix samples show a variety of beginning (upper left) and ending (lower right) frags. The 5x5 format is well-suited for showing such variety.

Updates

The one-way span of the (8,4) directed word chain network has been reduced from 17 to 16, but otherwise has the same character. As in the earlier article, the central portion of the core contains common four-letter word frags, but many of the frags at the begin­

ning or end are non-words (or, possibly, obsolete spellings in the OED). The portion of the core following the span is an example of a beginning sequence using mostly non-word frags.

Although it is possible to create very long (8,4) chains, it is more challenging to find chains of a specific length between stated ends. With a computer, I have gone one step further. In the following word to ways chains, wordster, wordplay and wordbook are used as often as needed, but otherwise no frag is repeated in this set. The series is not optimized; a longer set is possible. Recogniz­

ing shipable, rockling, overshoe, and roadster, note how easy it is to combine portions of these chains into one long one. Further­more, new sections like hand-clap-trap-door-post-lude-rick-yard­

land, etc., can be inserted here and there.
Here are explanations of a few of my favorite eight-letter words:

*a foreiron* (Web 3) is not a golf club but part of a plow; a cock-head is not an upside-down cocktail but the stem of a grinding wheel; *bearfoot* (Web 2) is an herb; *tailhead* (Web 3) is the base of an animal’s tail; *burnover* (Web 3) is an imperfectly-burned brick; *hightide* (Web 2) is a festival; a *bookmate* (Web 2) is a schoolmate; *downgone* (Web 2) means downcast or unhappy; *gonesome* (Web 2) means having a gone feeling; a *workboat* (Web 2) is indeed a boat; *workship* (Web 2) is a variation of workmanship; a *landship* (Web 3) is a large covered wagon; *bookland* (Web 3) is not a place to read books but the opposite of *folkland* (Web 3), a legal term regarding landholding; *likewalk* (Chambers) is an alternate of *lykewake* or *latewake* (Web 3), simply a wake; *coneplate* or *coneplate* (Web 3) is a Mexican name for an animal commonly known as a hog-nosed skunk.

Part 2 gave a list of reversible words (such as *bookcase* and *casebook*). This list, given in the appendix, is now 150 words long with 91 different frags represented. All 91 frags are core frags and common four-letter words. 56 of these constitute a core with bidirectional links as in the standard Carrollian word network. This core is shown below; it has a span of 16.

```
| long   | case   | play | boats, hang, hold, pass, slip, walk, wing |
| note   | book   | folk | |
| dove   | ring   | head | |
| work   | hand   | mark | down, over, 
| mate   | turn   | |
| skin   | ship   | fast | wood |
| rail   | shop   | face | bush-buck |
|   |   |   | 
```

Other aspects of (8,4) chains are incorporated in the following two puzzles:

**PUZZLE 1:** Using only the 28 four-letter frags listed below, how
many 4x4 meshes can you construct? All eight-letter combinations must be listed as solid words in either Web 2, Web 3, OSPD or Chambers. A frag may not be used more than once in a mesh.

back ball band bell bone door dove fast fire fish head hold lady land like long ring ship side skin star tail wash weed wind wood worm

PUZZLE 2: Fill a blank with an eight-letter word so as to make two more eight-letter words. There might be more than one way to fill each blank. The frags of a fill-in word need not be words.

A. boat____ ship B. back____ side C. head____ tail
sample: tailwind stopover longhorn
D. bookmark____ dingbats E. pinafore____ dateable

APPENDIX

backfall backfire backhaul backkick backstop bandtail barabara birdcage birdseed biridsong boilover bonefish bonetail bookcase bookland bookwork bootjack bushbush burnover burnside bushwick bushwood cagebird caracara casebook chowchow coattail comedown couscous deerkill dishwash dividivi
dovering downcome downface downplay downtake downturn downwash facedown fallback fallfish fastland folkland ganggang gangplow greegree handwork hangover hardpans haulback haulover headlong headnote headrail heading headskin headwork hillside holdover hometown hookweed hotshots jackboot kavakava kickback killdeer kouskous landbook landfast landfolk landmark landwash lavalava likewise lineside lockpick longhead markland matamara mateship notehead overboil overburn overhang overhaul overhold overpass overslip overtake overturn overwalk overwing panshard passover picklock pirlipir playdown plowgang pondfish railhead ringdove ringhead rootworm rootship shipward shipwork shopwork shotstar sideburn sidehill sideline skinhead slipover songbird starshot stopback tailband tailbone tailcoat takedown takeover ticktick townhome turndown turnover walkover wardship washdown washland weedhook wingover wiselike woodbush woodfish woodworm workbook workhand workhead workship workshop workroot woodworm

deaf-ear-dead-line-back-down-hand
wood-side-wash-land-rail
fish-bone-tail-wind-road
bolt-work-head-ring-stem
hole-able-gate-like-ring
arch-fire-back-stop-over
king-side-band-work-hand
fish-bone-tail-head-rail
polc-wood-ring-ringshine
star-vem-root-wise-lier
drop-kick-down-time-keep
line-back-wash-able
side-bone-tail-head-gate
rose-wood-ring-like
leaf-vem-root-wise-ness
anti-king-head-wind-root
polc-wood-land-ship-word
star-fish-line-side-walk
ring-tail-back-wash-out
neck-band-work-hand-wear
deck-hand-hold-over-hard
head-line-back-fire-tail
rail-side-bone-wood-oid
road-show-yard-land-ward
book-shop-work-folk-note
free-hand-line-side-rose
hold-fast-back-bone-wood
over-land-wash-tail-wing
word-book-work-head-ring
play-mate-ship-ward-talk
anti-body-surf-boat-bill
polc-wood-fish-tail-head
burn-side-line-back-land
over-lock-work-band-rail
door-step-wise-ling-bird
high-bush-fire-pink-root
tide-land-fall-fire-worm
head-line-back-bone-wood
ring-side-wash-tail-wing
lock-step-down-ward-ship
hair-line-side-show-down
slip-back-bone-yard-land
over-fire-wood-work-book
hard-ball-cock-head-rest
ware-room-mate-ship-ward
even-down-turn-tail-race
hand-hold-over-head-line
bill-back-land-raise-side
fish-wood-wind-road-show
wife-ward-ship-wood
burn-over-crop-land-sick
side-long-head-ward-room
wash-hand-wood-ship-mate
down-play-book-word-less
gone-some-wise-ness
deer-hair-line-ward-ward
horn-tail-back-wash-room
fish-bone-wood-work-some
bolt-head-note-book-wise
rope-band-case-word
home-body-surf-ship-wife
life-work-boat-tall-ward
long-hand-bill-head-ship
tail-line-back-band-ward
wood-side-spin-ster-ling
bear-foot-back-band-case
wood-work-hand-ship-wood
cock-boot-bill-book-wood
bell-tail-head-land-like
wind-ward-ship-side-walk
blue-wing-land-lock
cock-tail-back-wash-down
head-band-wood-hand-play
note-case-book-rest-ward
shee-fish-small-word
ring-tail-back-hand-play
side-bone-wood-work-some
long-head-land-book-wise
hair-lock-wood-ward
shee-fish-small-word
ring-tail-back-door-bell
side-band-wood-head-wind
show-case-book-land-ward
lace-wood-shop-mark-note
hand-blow-down-play-date
hold-back-wash-work-book
over-fire-tail-head-land
long-wood-wind-ring-lock
root-ward-ship-side-step
wild-fire-plot-foot-note
wood-fall-back-band-case
rock-fish-bone-wood-book
hair-tail-ship-word
bell-wind-ring-ship-last
down-fall-fish-pole-star
line-band-tail-ship-land
wash-work-head-ship
hand-band-note-wise-word
over-king-fish-pole-star
fire-side-bone-word
back-wang-tail-ship
wash-work-head-ship
hand-band-note-wise-word
blow-fish-hold-over-word
pipe-line-back-word-book
wood-side-bone-head-land
land-wash-tail-ship-land
lock-down-ward-ship
bell-tail-bone-head-land
fish-line-side-bone
fish-line-side-bone
field-back-band-word
over-door-case-book-rest
side-flat-long-hair
land-iron-bone-word
slip-back-wind-fish-wood
over-hand-blow-line-side
pass-book-case-work-word
chee-king-fish-word
ring-side-long-band-wood
head-long-tail-ship
land-line-back-all-ways
wire-work-hand-out-sides
anti-slip-over-fall-fish
type-form-feed-back-wood
face-work-head-land
down-hand-ship-side-burn
pipe-line-like-ship-able
draw-stop-over-fish
tube-wood-hand-fish
rose-head-line-back-wood
bush-land-side-wash-tail
fire-lock-step-down-ship
farm-hand-play-down-ship
land-line-back-wood
iron-side-bone-word
head-long-tail-ship
ring-neck-band-fish
hair-line-side-wash-down
slip-back-band-word-hand
over-fire-tail-head-land
long-wood-wind-ring-ship
wood-rock-fish-word
blow-down-hold-over-play
fish-line-word-book
wood-side-bone-head-ship
land-wash-tail-ship
lock-able-gate-ward-ship
bush-land-iron-side-show
wood-fall-back-wash-down
wind-fish-tail-tail-pipe
ring-bolt-word-head-ship
lock-hole-able-gate-ages
cape-line-back-down-ship
ring-side-wash-band-fast
bone-wood-work-book-land
wood-wind-ship-word
grub-root-wood-ness
sand-blow-iron-head-word
fish-line-side-long-ship
hold-back-band-ship-gate
over-fire-fish-wood-ward
live-trap-row-fall-ages